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Bulletin I2403 rev. A 07/00

International
IOR Rectifier

22RIA SERIES

MEDIUM POWER THYRISTORS **Stud Version**

22A

Features

- Improved glass passivation for high reliability and exceptional stability at high temperature
- High di/dt and dv/dt capabilities
- Standard package
- Low thermal resistance
- Metric threads version available
- Types up to 1600V V_{DRM}/ V_{RRM}

Typical Applications

- Medium power switching
- Phase control applications
- Can be supplied to meet stringent military, aerospace and other high-reliability requirements

Major Ratings and Characteristics

Parameters		22RIA 10 to 120	22RIA 140 to 160	Units
$I_{T(AV)}$		22	22	A
	@ T_C	85	85	°C
$I_{T(RMS)}$		35	35	A
I_{TSM}	@50Hz	400	340	A
	@60Hz	420	355	A
I^2t	@50Hz	793	575	A^2s
	@60Hz	724	525	A^2s
V_{DRM}/V_{RRM}		100 to 1200	1400 to 1600	V
t_q	typical	110		µs
T_J		- 65 to 125		°C

Case Style
TO-208AA (TO-48)

ELECTRICAL SPECIFICATIONS

Voltage Ratings

Type number	Voltage Code	V_{DRM}/V_{RRM}, max. repetitive peak and off-state voltage (1) V	V_{RSM}, maximum non-repetitive peak voltage (2) V	I_{DRM}/I_{RRM} max. @ $T_J = T_J$ max. mA
22RIA	10	100	150	20
	20	200	300	10
	40	400	500	
	60	600	700	
	80	800	900	
	100	1000	1100	
	120	1200	1300	
	140	1400	1500	
	160	1600	1700	

(1) Units may be broken over non-repetitively in the off-state direction without damage, if dI/dt does not exceed 20A/µs
(2) For voltage pulses with $t_p \leq 5$ms

On-state Conduction

Parameter		22RIA 10 to 120	22RIA 140 to 160	Units	Conditions		
$I_{T(AV)}$	Max. average on-state current	22	22	A	180° sinusoidal conduction		
	@ Case temperature	85	85	°C			
$I_{T(RMS)}$	Max. RMS on-state current	35	35	A			
I_{TSM}	Max. peak, one-cycle non-repetitive surge current	400	340	A	t = 10ms	No voltage reapplied	Sinusoidal half wave, Initial $T_J = T_J$ max.
		420	355		t = 8.3ms		
		335	285		t = 10ms	100% V_{RRM} reapplied	
		355	300		t = 8.3ms		
I^2t	Maximum I^2t for fusing	793	575	A^2s	t = 10ms	No voltage reapplied	
		724	525		t = 8.3ms		
		560	405		t = 10ms	100% V_{RRM} reapplied	
		515	370		t = 8.3ms		
$I^2\sqrt{t}$	Maximum $I^2\sqrt{t}$ for fusing	7930	5750	$A^2\sqrt{s}$	t = 0.1 to 10ms, no voltage reapplied, $T_J = T_J$ max.		
$V_{T(TO)1}$	Low level value of threshold voltage	0.83	1.01	V	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$, $T_J = T_J$ max.		
$V_{T(TO)2}$	High level value of threshold voltage	0.95	1.17		$(I > \pi \times I_{T(AV)})$, $T_J = T_J$ max.		
r_{t1}	Low level value of on-state slope resistance	14.9	12.24	mΩ	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$, $T_J = T_J$ max.		
r_{t2}	High level value of on-state slope resistance	13.4	10.35		$(I > \pi \times I_{T(AV)})$, $T_J = T_J$ max.		
V_{TM}	Max. on-state voltage	1.70	---	V	I_{pk}= 70 A, T_J = 25°C		
		---	1.80				
I_H	Maximum holding current	130		mA	T_J = 25°C. Anode supply 6V, resistive load,		
I_L	Latching current	200					

Switching

	Parameter		22RIA	Units	Conditions
di/dt	Max. rate of rise of turned-on current	$V_{DRM} \leq 600V$	200	A/µs	$T_J = T_J$ max., V_{DM} = rated V_{DRM} Gate pulse = 20V, 15Ω, t_p = 6µs, t_r = 0.1µs max. I_{TM} = (2x rated di/dt) A
		$V_{DRM} \leq 800V$	180		
		$V_{DRM} \leq 1000V$	160		
		$V_{DRM} \leq 1600V$	150		
t_{gt}	Typical turn-on time		0.9	µs	T_J = 25°C, at = rated V_{DRM}/V_{RRM}, T_J = 125°C
t_{rr}	Typical reverse recovery time		4		$T_J = T_J$ max., $I_{TM} = I_{T(AV)}$, t_p > 200µs, di/dt = -10A/µs
t_q	Typical turn-off time		110		$T_J = T_J$ max., $I_{TM} = I_{T(AV)}$, t_p > 200µs, V_R = 100V, di/dt = -10A/µs, dv/dt = 20V/µs linear to 67% V_{DRM}, gate bias 0V-100W

(*) t_q = 10µsup to 600V, t_q = 30µs up to 1600V available on special request.

Blocking

	Parameter	22RIA	Units	Conditions
dv/dt	Max. critical rate of rise of off-state voltage	100	V/µs	$T_J = T_J$ max. linear to 100% rated V_{DRM}
		300 (*)		$T_J = T_J$ max. linear to 67% rated V_{DRM}

(**) Available with: dv/dt = 1000V/µs, to complete code add S90 i.e. 22RIA160S90.

Triggering

	Parameter	22RIA	Units	Conditions	
P_{GM}	Maximum peak gate power	8.0	W	$T_J = T_J$ max.	
$P_{G(AV)}$	Maximum average gate power	2.0			
I_{GM}	Max. peak positive gate current	1.5	A	$T_J = T_J$ max.	
$-V_{GM}$	Maximum peak negative gate voltage	10	V	$T_J = T_J$ max.	
I_{GT}	DC gate current required to trigger	90	mA	T_J = - 65°C	Max. required gate trigger current/ voltage are the lowest value which will trigger all units 6V anode-to-cathode applied
		60		T_J = 25°C	
		35		T_J = 125°C	
V_{GT}	DC gate voltage required to trigger	3.0	V	T_J = - 65°C	
		2.0		T_J = 25°C	
		1.0		T_J = 125°C	
I_{GD}	DC gate current not to trigger	2.0	mA	$T_J = T_J$ max., V_{DRM} = rated value	
V_{GD}	DC gate voltage not to trigger	0.2	V	$T_J = T_J$ max. V_{DRM} = rated value	Max. gate current/ voltage not to trigger is the max. value which will not trigger any unit with rated V_{DRM} anode-to-cathode applied

Thermal and Mechanical Specification

	Parameter	22RIA		Units	Conditions
T_J	Max. operating temperature range	- 65 to 125		°C	
T_{stg}	Max. storage temperature range	- 65 to 125		°C	
R_{thJC}	Max. thermal resistance, junction to case	0.86		K/W	DC operation
R_{thCS}	Max. thermal resistance, case to heatsink	0.35		K/W	Mounting surface, smooth, flat and greased
T	Mounting torque	to nut	to device		
		20(27.5)	25	lbf-in	Lubricated threads
		0.23(0.32)	0.29	kgf.m	(Non-lubricated threads)
		2.3(3.1)	2.8	Nm	
wt	Approximate weight	14 (0.49)		g (oz)	
	Case style	TO-208AA (TO-48)			See Outline Table

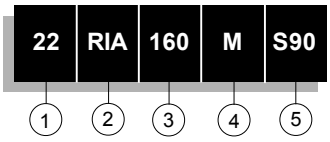
ΔR_{thJC} Conduction

(The following table shows the increment of thermal resistence R_{thJC} when devices operate at different conduction angles than DC)

Conduction angle	Sinusoidal conduction	Rectangular conduction	Units	Conditions
180°	0.21	0.15	K/W	$T_J = T_J$ max.
120°	0.25	0.25		
90°	0.31	0.34		
60°	0.45	0.47		
30°	0.76	0.76		

Ordering Information Table

Device Code



1 - Current code

2 - Essential part number

3 - Voltage code: Code x 10 = V_{RRM} (See Voltage Rating Table)

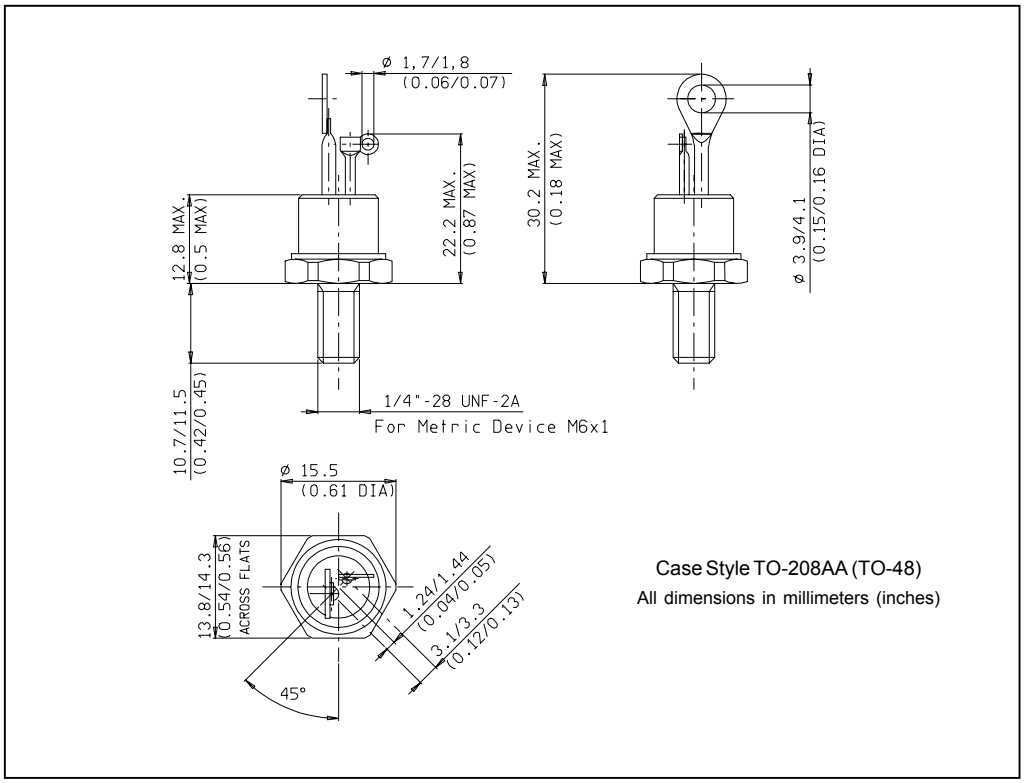
4 - None = Stud base TO-208AA (TO-48) 1/4" 28UNF-2A

M = Stud base TO-208AA (TO-48) M6 X 1

5 - Critical dv/dt: None = 300V/µs (Standard value)

S90 = 1000V/µs (Special selection)

Outline Table



Case Style TO-208AA (TO-48)
All dimensions in millimeters (inches)

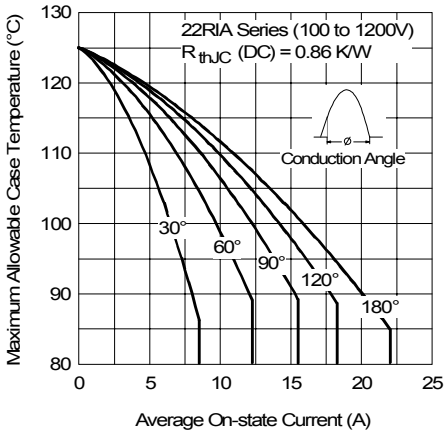


Fig. 1 - Current Ratings Characteristic

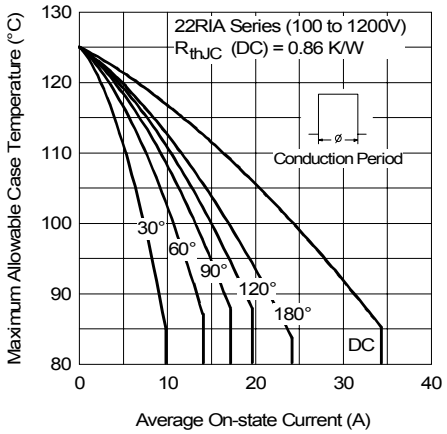


Fig. 2 - Current Ratings Characteristic

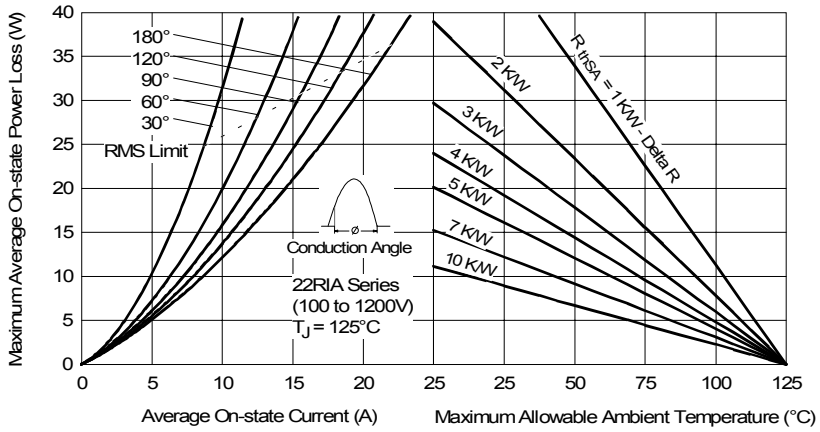


Fig. 3 - On-state Power Loss Characteristics

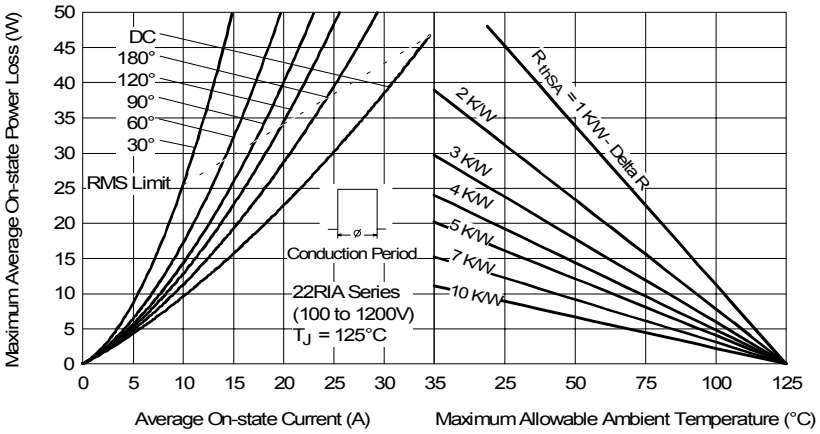


Fig. 4 - On-state Power Loss Characteristics

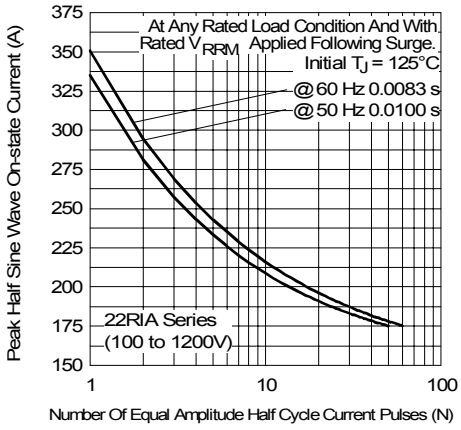

Peak Half Sine Wave On-state Current (A)
At Any Rated Load Condition And With
Rated VRRM Applied Following Surge.
Initial TJ = 125°C
@ 60 Hz 0.0083 s
@ 50 Hz 0.0100 s
22RIA Series
(100 to 1200V)
Number Of Equal Amplitude Half Cycle Current Pulses (N)

Fig. 5 - Maximum Non-Repetitive Surge Current

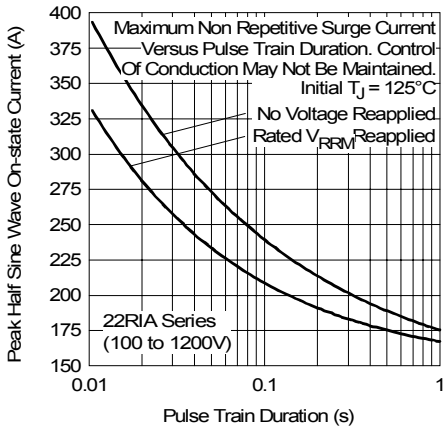

Peak Half Sine Wave On-state Current (A)
Maximum Non Repetitive Surge Current
Versus Pulse Train Duration. Control
Of Conduction May Not Be Maintained.
Initial TJ = 125°C
No Voltage Reapplied
Rated VRRM Reapplied
22RIA Series
(100 to 1200V)
Pulse Train Duration (s)

Fig. 6 - Maximum Non-Repetitive Surge Current

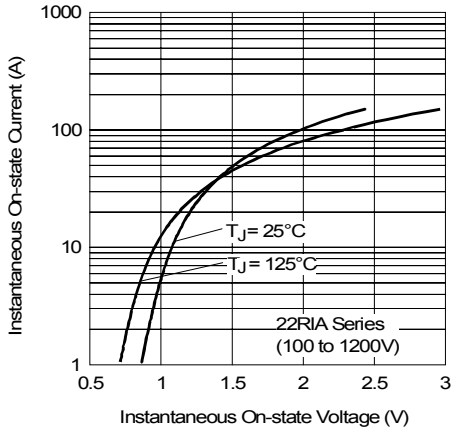


Fig. 7 - Forward Voltage Drop Characteristics

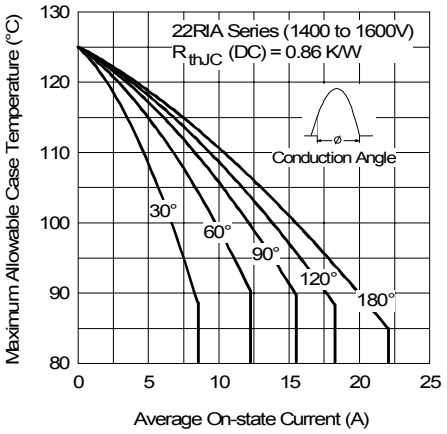


Fig. 8 - Current Ratings Characteristics

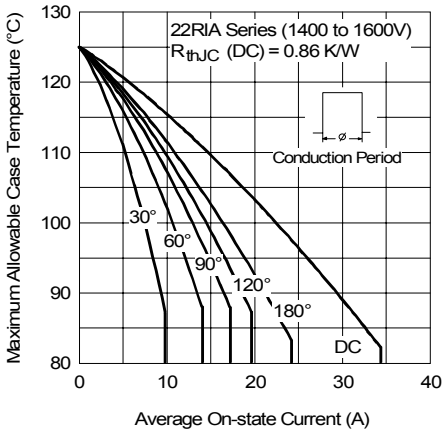


Fig. 9 - Current Ratings Characteristics

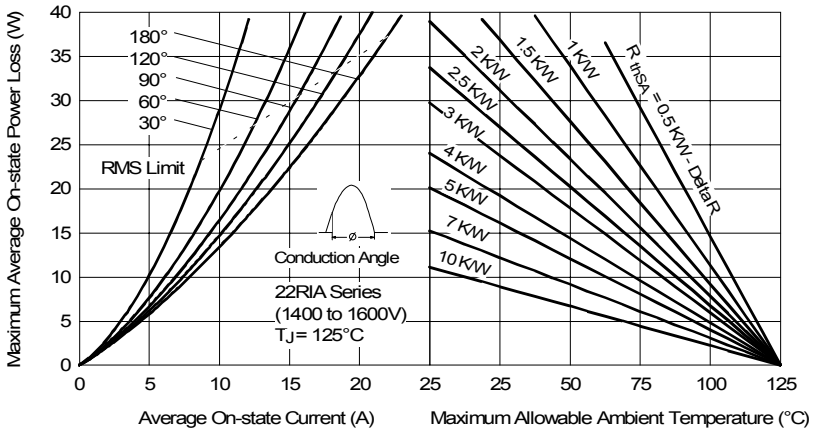


Fig. 10 - On-state Power Loss Characteristics

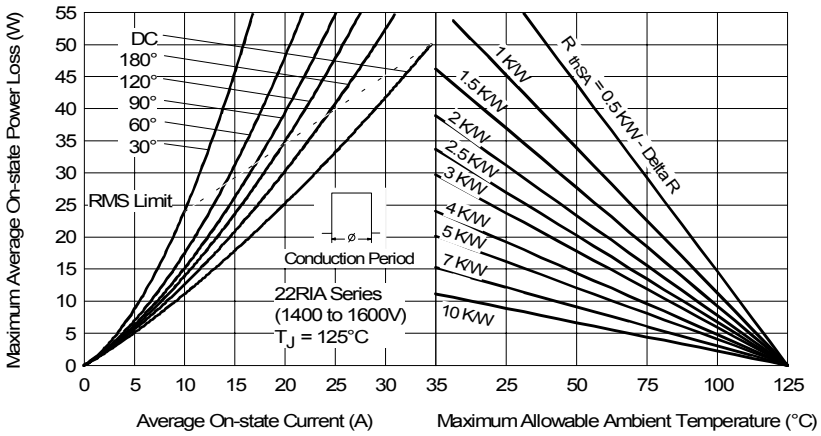


Fig. 11 - On-state Power Loss Characteristics

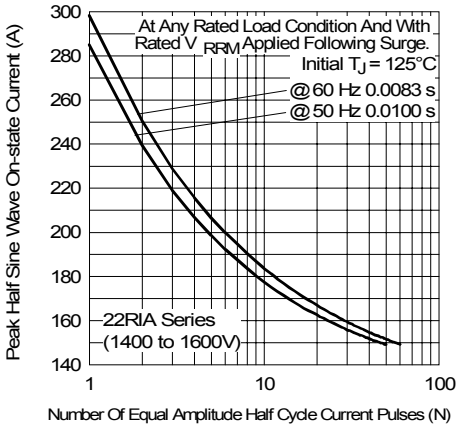

Peak Half Sine Wave On-state Current (A)
At Any Rated Load Condition And With
Rated V_{RRM} Applied Following Surge.
Initial T_J = 125°C
@ 60 Hz 0.0083 s
@ 50 Hz 0.0100 s
22RIA Series
(1400 to 1600V)
Number Of Equal Amplitude Half Cycle Current Pulses (N)

Fig. 12 - Maximum Non-Repetitive Surge Current

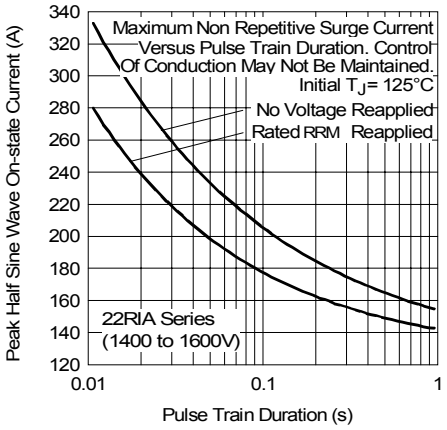

Peak Half Sine Wave On-state Current (A)
Maximum Non Repetitive Surge Current
Versus Pulse Train Duration. Control
Of Conduction May Not Be Maintained.
Initial T_J = 125°C
No Voltage Reapplied
Rated V_{RRM} Reapplied
22RIA Series
(1400 to 1600V)
Pulse Train Duration (s)

Fig. 13 - Maximum Non-Repetitive Surge Current

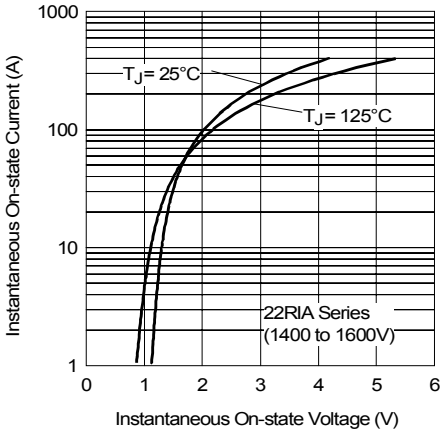


Fig. 14 - Forward Voltage Drop Characteristics

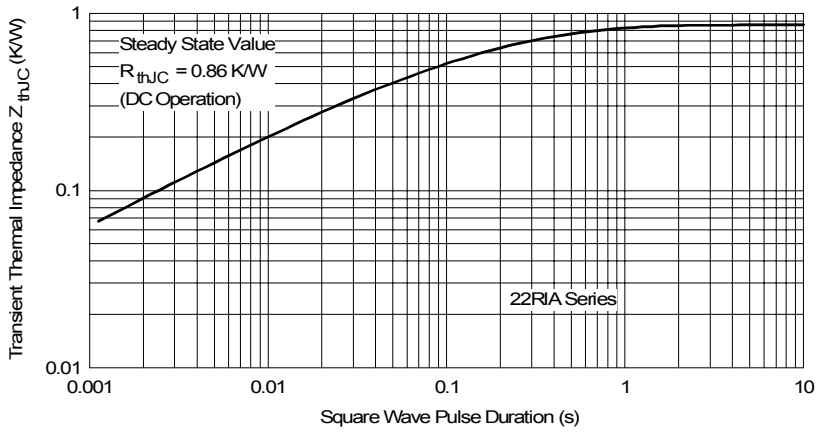


Fig. 15 - Thermal Impedance Z_{thJC} Characteristics

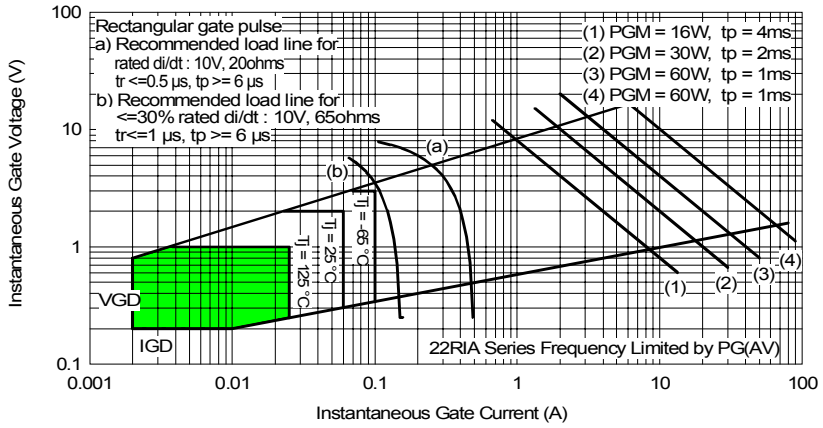


Fig. 16 - Gate Characteristics

International
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WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245 U.S.A. Tel: (310) 322 3331. Fax: (310) 322 3332.
EUROPEAN HEADQUARTERS: Hurst Green, Oxted, Surrey RH8 9BB, U.K. Tel: ++ 44 1883 732020. Fax: ++ 44 1883 733408.
IR CANADA: 15 Lincoln Court, Brampton, Markham, Ontario L6T3Z2. Tel: (905) 453 2200. Fax: (905) 475 8801.
IR GERMANY: Saalburgstrasse 157, 61350 Bad Homburg. Tel: ++ 49 6172 96590. Fax: ++ 49 6172 965933.
IR ITALY: Via Liguria 49, 10071 Borgaro, Torino. Tel: ++ 39 11 4510111. Fax: ++ 39 11 4510220.
IR FAR EAST: K&H Bldg., 2F, 30-4 Nishi-Ikebukuro 3-Chome, Toshima-Ku, Tokyo, Japan 171. Tel: 81 3 3983 0086.
IR SOUTHEAST ASIA: 1 Kim Seng Promenade, Great World City West Tower,13-11, Singapore 237994. Tel: ++ 65 838 4630.
IR TAIWAN: 16 Fl. Suite D.207, Sec. 2, Tun Haw South Road, Taipei, 10673, Taiwan. Tel: 886 2 2377 9936.

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